SLOVENSKI STANDARD
SIST ENV 13563:2002

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Oprema za nadzor in vodenje cestnega prometa - Detektorji vozil

Traffic control equipment - Vehicle detectors

Anlagen zur Verkehrssteuerung - Fahrzeug-Detektoren

Equipement de régulation du trafic - Détecteurs de véhicules

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93.080.30	Cestna oprema in pomožne naprave	Road equipment and installations

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Traffic control equipment - Vehicle detectors

Equipement de régulation du trafic - Détecteurs de véhicules

Anlagen zur Verkehrssteuerung - Fahrzeug-Detektoren

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 226 "Road equipment", the secretariat of which is held by AFNOR.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

The Annexes A and B are normative, the Annexes C and D are informative. Annex D contains examples of certificates.

Introduction

This European Prestandard specifies the generic performance requirements of detectors for use in traffic control systems. To permit flexibility, no normative reference is made to specific technologies, nor to particular applications in which a detector may be used. The principal criteria used are those of detection target (e.g. car, pedal cycle) and function (e.g. presence, speed).

All technologies used in detection are influenced in varying degrees by operational/environmental conditions, but the effects vary according to the technology. To attempt to address this issue, the Prestandard includes an Annex C which highlights some of the conditions which affect the various technologies currently used in detection.

1 Scope

This European Prestandard specifies the requirements for detectors used in traffic systems to control road vehicles using traffic signals. It specifies these requirements in function only. The performance requirements apply where detectors, whatever the technology used, provide the sensing zone, together with the processing needed to derive the required output. A special case exists for loop detectors where the loop layout determines the sensing zone in part.

This European Prestandard is applicable to detectors which operate by passive detection. It is not applicable to guided vehicles (trams).

Environmental, electrical safety and EMC requirements are specified in prEN 50278:1997 that makes reference to prEN 50293:1997.

2 Normative references

This European Prestandard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

prEN 50278 : 1997
Road traffic signal systems

prEN 50293 : 1997
Electromagnetic compatibility - Road traffic signal systems - Product standard

3 Definitions

For the purposes of this Standard, the following definitions apply:

3.1 individual count (Icount): The determination of the number of targets that have either entered or left the zone of detection. Units are integer.

3.2 total count (Tcount): The determination of the total number of targets within the zone of detection. Units are integer.

3.3 detection: The determination that a target, or group of targets, is within the detection zone and behaving in the manner required to be detected.

3.4 detection offset: The distance, in the *Y* direction, that the detection zone is displaced from the physical location of the detector. (The detector is assumed to be 'small'), see figure 1.

NOTE: This is not applicable to inductive loop detectors.

3.5 detection range: The distance in the *X* direction from the nearest edge of the possible detection zone to the physical location of the detector, see figure 1.

NOTE: In the case of an inductive loop detector this is the feeder length.

3.6 detection zone: The area on the road surface where the target or the group of targets actuates the detector.

NOTE: The detection zone is specified by offset rectangles. The rectangles are specified by co-ordinates X_0, X_1, X_2, X_3, Y_0, Y_1, Y_2 and Y_3 as shown in figure 1.

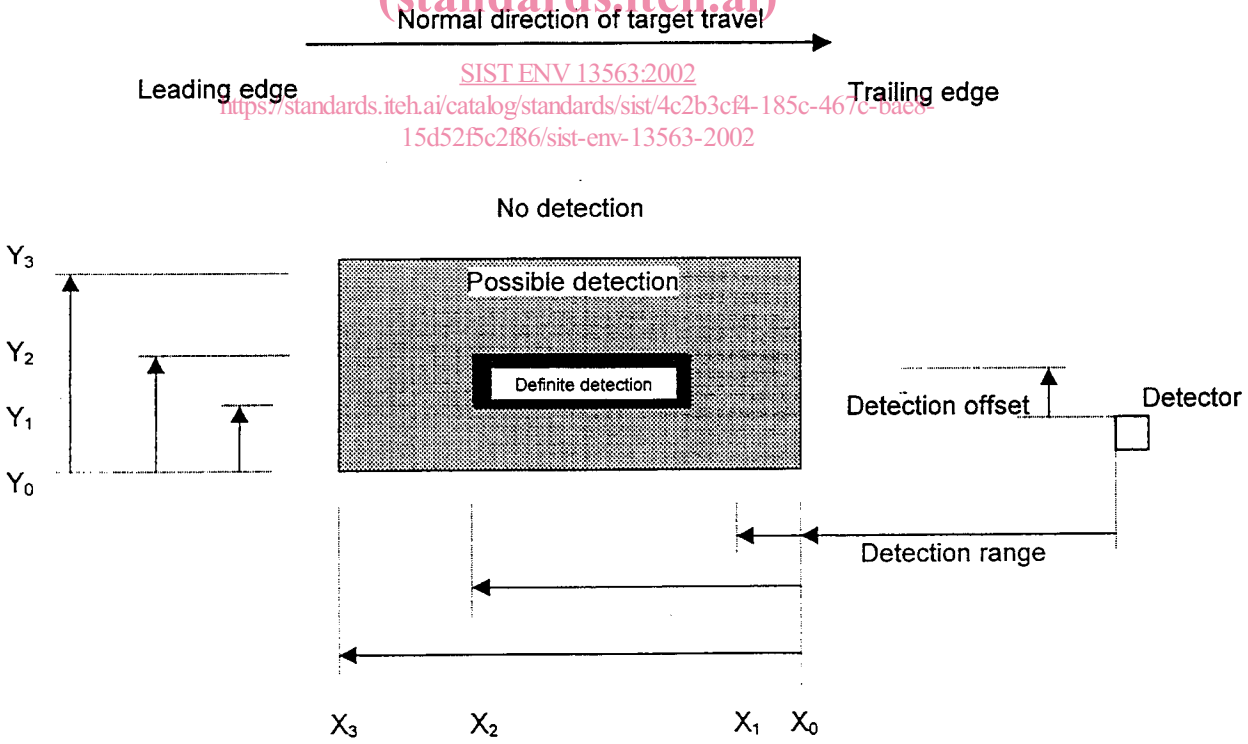

Figure 1: Detection zone and range

3.7 detector: A device which, when actuated by a target, enables the required function to be performed.

3.8 direction discrimination: The determination of the direction of travel of a target within the detection zone. It has no units.

3.9 feeder: The cable between the physical edge of the loop and the input to the electronic component of the loop detector.

3.10 function: The determination of the manner in which a target or a group of targets is behaving whilst in the detection zone.

NOTE: The function may be performed by a detector or group of detectors acting together to perform the required function(s).

3.11 gap: The determination of the distance or time between the front of a target within a single detection zone and the rear of the vehicle ahead. Units are distance in meters or time in seconds.

3.12 lock-up: The state where the detector gives a continuous detect indication with no target present and the presence time has expired.

3.13 occupancy: The determination of the ratio of the actual measured duration of the presence of target(s) to the maximum possible duration of the presence of targets(s). The result is a ratio normally expressed as a percentage.

3.14 passive detection: Detection which depends neither on co-operation in the detection process by the target, except by reason of its existence, nor upon the target carrying any additional device as part of the detection process.

3.15 presence: The determination of when a target is present within the detection zone. It has two states which are 'target present' and 'target not present'. It has no units. The target can be in motion or stationary.

3.16 presence time: The time for which the detector determines a target is continuously present. Units are time.

3.17 recovery time: The minimum time in which a detector will respond correctly to a target after ceasing to respond to the previous target after a sustained actuation. This is illustrated in figure 2.

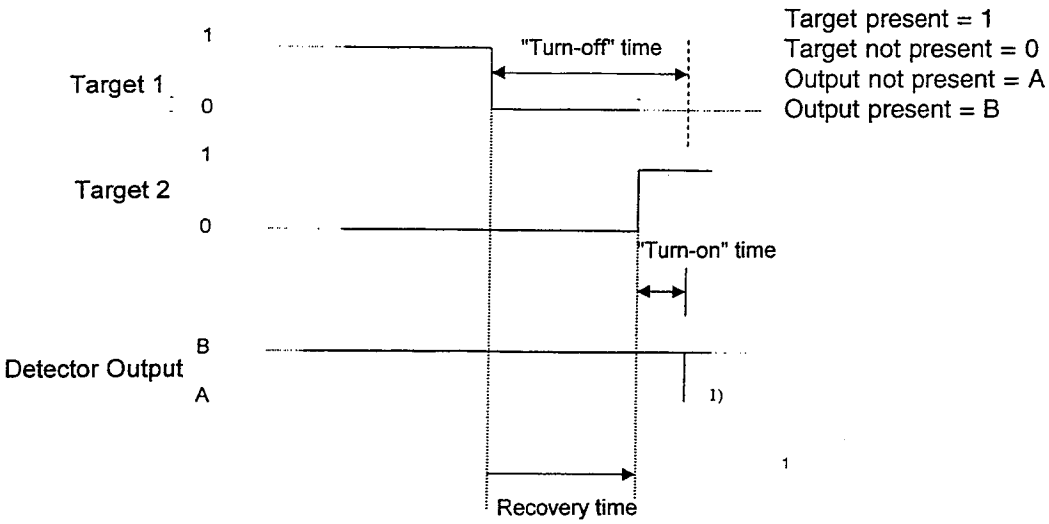

Figure 2: Turn-on and turn-off time, recovery time

3.18 speed discrimination: The selection of targets that are moving either above or below a specified speed threshold. It should be noted that there is a speed band, the possible detection zone see figure 3, where either state is permitted.

NOTE: In this European Standard the speed means the result of the determination of the speed of a target within the detection zone. Units are speed in kilometres per hour or metre per second.

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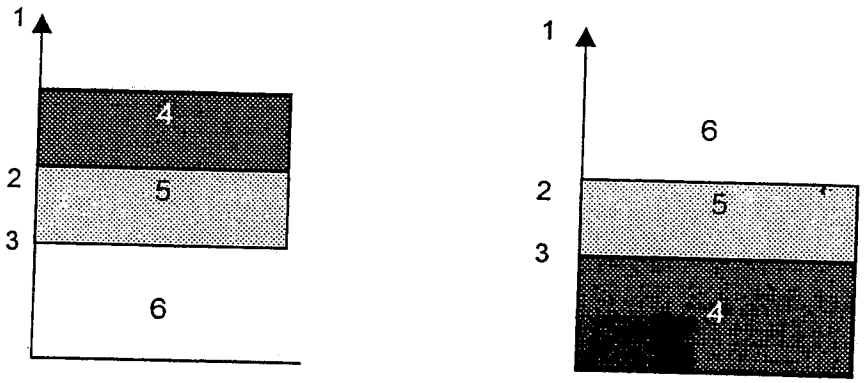
[1] This pulse shows the limiting case for a detector just able to recover.No pulse would occur for target 2 entering sooner, a longer pulse would occur for target 2 entering later.

1 speed
2 maximum threshold
3 minimum threshold
4 definite detection
5 possible detection
6 no detection



a) Speed above threshold

b) Speed below threshold

Figure 3: Speed discrimination thresholds

3.19 target type discrimination: The selection of a particular target type within the overall group of vehicles. It has no units.

3.20 turn-off time: The time the detector takes to cease to give an output after the target has left the detection zone, see figure 2.

3.21 turn-on time: The time a detector takes to give an output after a target has entered the detection zone, see figure 2.

4 Requirements

4.1 Target Categories

There are two main categories of targets covered in this standard:

– motor vehicles;

– pedal cycles.

In addition special targets, e.g. buses, large vehicles, may be required to be detected and/or distinguished separately. The parameters of such targets shall be adequately specified for the detector to be subjected to the tests required by clause 5.

4.2 Functions

Detectors shall perform one or more of the following functions:

a) Presence (for detectors which only detect the presence of a target when it is in motion, the supplier shall specify the maximum and minimum speed thresholds as for speed discrimination.);

b) presence time;

c) individual count;

d) total count;

e) speed;

f) gap;

g) occupancy;

h) direction discrimination;

i) target type discrimination;

j) speed discrimination.

4.3 Performance requirements

4.3.1 Function

Detectors shall obtain the stated accuracy for the chosen function and target (target group) when tested in accordance with clause 5.

The accuracy to which each function is performed shall be determined for a statistically significant number of actuations for the required target groups. Three classes are available as specified in table 1.

Table 1: Accuracy classes

Function	Type of test	Error definition	Maximum error for class:			Ratio for error definition		Remarks
			1	2	3	Portion	Reference volume	
Presence	positive accuracy	*n/m* (%)	2	5	10	number n of incorrect actuations by targets in lane	total number m of events for targets in lane	
	negative accuracy	*n/m* (%)	2	5	10	number n of (unwanted) actuations by targets in adjacent lane	total number m of events for targets in adjacent lane	
Icount, Tcount	positive accuracy	*n/m* (%)	2	5	10	number n of incorrect counts by targets in lane	total number m of events for targets in lane	no compensation of positive and negative miscounts; requires being able to observe each count stage in the detector;
	negative accuracy	*n/m* (%)	2	5	10	number n of (unwanted) counts by targets in adjacent lane	total number m of events for targets in adjacent lane	same as presence but different error levels
Speed	positive accuracy	$\Delta v/v$ (%)	±2	±5	±10	95 %	total number m of events for targets in lane	v = speed
	negative accuracy	*n/m* (%)	2	5	10	number n of (unwanted) speed actuations by targets in adjacent lane	total number m of events for targets in adjacent lane	
Gap	positive accuracy	ΔT (s) or ΔD (m)	±0,1 ±1,4	±0,3 ±4	±0,5 ±7	95 %	total number of gap events for targets in lane and gap T = 1...5 s, speed v = 20...80 km/h	T = gap in time, D = gap in distance;
	negative accuracy	*n/m* (%)	2	5	10	number n of (unwanted) gap actuations by targets in adjacent lane	total number m of events for targets in adjacent lane	the zone length has to be defined by the manufacturer (shall be included in gap calculation)
Occupancy	positive accuracy	$\Delta O/O$ (%)	±5	±10	±20	95 %	total number of intervals calculated from all events for targets in lane	O = occupancy value; interval to be defined (e.g. between 2 targets);
	negative accuracy	*n/m* (%)	2	5	10	number n of (unwanted) occupancy actuations by targets in adjacent lane	total number m of events for targets in adjacent lane	the zone length has to be defined by the manufacturer (shall be included in occupancy calculation)
Direction	positive accuracy	*n/m*(%)	2	5	10	number n of incorrect actuations by targets in lane in the specific direction	total number m of events for targets in lane in the specific direction	mixture of events shown in event tables (e.g. 1:1)
	negative accuracy	*n/m* (%)	2	5	10	number n of (unwanted) actuations by targets in lane travelling in reverse direction or by ones in adjacent lane travelling in same direction	total number m of events for targets in lane travelling in reverse direction and for ones in adjacent lane travelling in same direction	

Table 1 (concluded)

Target type	positive accuracy	*n/m* (%)	2	5	10	number *n* of incorrect actuations by specific targets in lane	total number *m* of events for specific targets in lane	
	negative accuracy	*n/m* (%)	2	5	10	number *n* of (unwanted) actuations by other target types in lane or by specific targets in adjacent lane	total number *m* of events for other targets travelling in lane and specific targets travelling in adjacent lane	mixture of target types shown in event tables (e.g. 1:1)
Speed discrimination	positive accuracy	*e*(%)	5	10	20	95 %	total number *m* of events for targets in lane with speed range in positive test interval(s) equal to threshold error band, *e*, (see figure B.2)	positive test interval(s) corresponding to min./max. speed threshold(s) below/above/-between (defined by manufacturer); in case of between both intervals have to be tested separately; *e* = declared threshold band (see figure B.2)
	negative accuracy	*e*(%)	5	10	20	95 %	total number *m* of events for targets in lane with speed range in negative test interval(s) equal to threshold error band, *e*, (see figure B.2) and for targets in adjacent lane with speed range in positive test interval(s)	same as for positive accuracy; mixture (ratio) of targets in positive and negative intervals shown in event tables (e.g. 1:1)
Presence Time	short time	$\Delta T/T$ (%)	±5	±10	±20	each time measurement	for all tests	*T* = Presence time, declared by manufacturer
	long time	$\Delta T/T$ (%)	+∞ -5	+∞ -10	+∞ -20	each time measurement	for all tests	only lower limit requires to be tested; *T* = Presence time, declared by manufacturer
Recovery Time	events	*T* (s)	1	2		each event	all events with actual gap = *T* + (0,2...1 s)	*T* = Recovery time

NOTE 1: No classes are linked (including positive and negative).

NOTE 2: The values given in this table have not been validated but are considered to be representative of those used. They can be changed for the final standard.

4.3.2 Recovery time

Detectors shall obtain the times stated in table 1. Two classes are available.

4.4 Environmental and electromagnetic compatibility (EMC) requirements

The environmental requirements are defined in prEN 50278:1997, which makes reference to prEN 50293:1997 for EMC.

Where the detector is intended for incorporation into a host equipment, the requirements shall be met by the combined equipment. Where the detector is 'stand alone' the requirements shall be met by the detector alone.

5 Test methods

5.1 Principle

Testing of detectors shall be performed by monitoring the type and behaviour of vehicles located within the test site. Various events occur (or are set up) e.g. a specific vehicle type travelling at a specific speed. The response of the detector under test (DUT) is compared with that of the test site reference equipment and by this comparison the performance of the DUT is determined.

A number of events are observed to perform a test. The required tests and events are given in annex B.

5.2 Test site

Performance testing of targets in motion is carried out at a test site as specified in annex A.
For static tests, an (off road) subset may be used.

5.3 Zone types

The specified test site restricts testing to zone sizes of one or two lanes in width. The limit to zone length is determined by the site chosen and the reference equipment used.

Four zone types are defined for testing purposes. These are shown in figure 4. The test site loop layout, see figure A.1, provides loops approximating to these (there is no loop corresponding to zone type 4). The zone boundaries shown in these figures correspond to the definitions of figure 1.

There are several detectors that have two sub-zones to produce the required functional output (e.g. a pair of loop detectors for speed measurement), the processing equipment can optionally calculate the functional output that would be derived by this means.

Whilst accurate *X* zone boundaries are determined, only limited *Y* zone testing is performed. The *Y* zone tests are primarily intended to ensure that targets are detected only 'in lane', including those located at 'the edge', and targets in the adjacent lane are not detected.

Where zone boundaries are confined to a single lane, that is zone types 1 and 3, the 'zone of possible detection' should be aligned in the *Y* direction with the lane division. The supplier shall specify the 'definite detection' zone.